PROVIDING DUTY-FREE ACCESS TO AUSTRALIAN MARKETS FOR LEAST-DEVELOPED COUNTRIES: A GENERAL EQUILIBRIUM ANALYSIS

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Abstract

The Doha ministerial declaration commits industrialised countries to liberalising access for least-developed countries (LDCs) to their markets. Preferential trade policies have diverse impacts on the initiating country and its trading partners. These effects are of concern to scholars and policy makers. We use Australia as a case study to quantify the direct and indirect effects of providing preferential access to LDC imports entering Australian markets, using a global general equilibrium model of the world economy. LDCs are projected to benefit; Australia is predicted to lose, reflecting the dominance of trade diversion over trade creation effects and adverse terms of trade effects. However, the magnitude of the adverse effect on Australia is small. If one was to view this initiative as an exercise in foreign aid, it suggests that Australia can provide a significant benefit to the poorest nations with which it trades, at almost no cost to itself.

Key words: economic development, numerical simulation, preferential trading arrangements, trade policy.

JEL codes: C68, F14, O24.

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* The work described here was undertaken while both authors were at the Productivity Commission; however, the views expressed here are the authors' and should not be attributed to the Productivity Commission.

1 Introduction

The Doha ministerial declaration commits industrialised countries to providing duty- and quota-free access to their markets for goods originating from developing countries and, especially, least-developed countries (LDCs). Currently, 49 countries are designated by the United Nations (UN) as LDCs as their per capita incomes are among the lowest in the world (UNCTAD 2001b). The improved access is intended to be non-reciprocal, that is, the initiative will not require beneficiary LDCs to respond by lowering their own tariffs. In response to the Doha declaration, some industrialised countries have already provided tariff- and quota-free access to their markets. The European Union introduced the "Everything but Arms" initiative. Other industrialised countries including Australia have announced similar initiatives for LDCs' imports (UNCTAD 2001a).

Although increasing opportunities for trade alone is unlikely to resolve all the economic problems in LDCs, this policy is designed to provide an impetus for their economic development. From a donor country's point of view, therefore, it will be important to know, both qualitatively and quantitatively, what impact such an initiative may have on LDCs and on other trading partners, as well as on its own economy. This paper uses Australia, a small open economy, as a case study to quantify the economic impacts of removing tariffs on goods originating from LDCs on the economies of LDCs, on developing and developed country trading partners, and on the Australian economy itself.

Like many other industrialised countries, Australia already had preferential agreements with selected developing countries prior to this new policy initiative. This includes duty-free access to Australian markets by some developing countries, including LDCs, under the South Pacific Regional Trade and Economic Co-operation Agreement (SPARTECA). One of the main policy concerns in regard to the new initiative is the possible impact this new policy may have on SPARTECA members. The degree of trade diversion created by preferential

access for LDCs will play significant role in determining whether these effects are positive or negative.

As the assessment of this preferential trade policy involves many countries and commodities, it is conducted using a well-known and widely-used general equilibrium (GE) framework which captures bilateral trade between all major countries and regions in the world, and models individual country domestic economies, all at a high degree of commodity detail – the GTAP model (Hertel 1997). We decompose our results to a greater degree of disaggregation from that in the model database, by developing and applying a post-solution procedure which includes individual trading partners that are not separately identified in the original database, but are important in their relevance to policy considerations.

The remainder of this paper is organised as follows. Section 2 highlights some key factors that may influence the outcomes of preferential trade agreements (PTA) by briefly reviewing the literature on PTAs. Section 3 outlines the main features of the GE framework applied in our analysis and the post-simulation procedure. Section 4 describes Australian trade with LDCs and the policy initiatives modelled. Section 5 presents and discusses our results. The final section summarises the main findings and draws out policy implications.

2 The theory of preferential trade agreements

The traditional analysis of PTAs is based on the notion of "trade creation" and "trade diversion", introduced by Viner (1950). Since then, there has been an extensive literature on the effects of various PTAs such as customs unions and free trade areas.[1] Both partial equilibrium (PE) and general equilibrium approaches have been used in analysing the impacts of PTAs on various parties. As trade usually involves multiple trading partners, the PE

[1] For a recent survey, see Panagariya (2000).

approach is often unable to capture interactions between sectors and countries in consumption and production, and can produce misleading results.

Let us now highlight some of the effects that determine the outcomes of PTAs based on theoretical models. Imagine a simple stylised GE model with three countries (A, B and C) trading three goods (1, 2 and 3) with each other, where each country is assumed to produce and export one good and import the other two goods from its trading partners. Consumers in all countries are assumed to have identical preferences for the three goods. This pattern of trade and consumption implies that goods produced in different countries are imperfect substitutes in consumption. Initially, all countries impose a tariff on the imported goods (of which there are 2) and tariff revenue is redistributed to the consumer in a lump-sum fashion. In this framework, it can be shown that if the country introducing a tariff preference for one of its trading partners is too small to affect the world prices of the goods it exports and imports, then this country will normally benefit from preferential liberalisation. This case is effectively equivalent to a PE analysis of a small open economy, in which the terms of trade for the liberalising country are fixed and any change in world prices is ruled out by assumption.[2]

If the small country assumption is relaxed in a GE context, however, the above results will change. The feedback effects from the rest of the world alter the results for the liberalising country. As Bhagwati and Panagariya (1996) have shown in a similar analysis, the introduction of a tariff preference may benefit the preference receiver, and hurt the other partner and the liberalising country itself. This is because the liberalising country is no longer small relative to the rest of the world, implying that the tariff preference will lead to a deterioration of that country's terms of trade. As a result, the liberalising country may lose from its own preferential trade liberalisation. The intuition behind this result can be explained

[2] This is also the result of the Meade-Lipsey small-union model (Lipsey 1958).

by the concepts of trade creation and trade diversion first enunciated by Viner (1950). First, let country A produce and export good 1, and import goods 2 and 3. Then suppose that country A removes the tariff on good 2 imported from country B. The removal of tariffs expands the imports of good 2, which is beneficial trade creation. But, as good 2 and 3 are substitutes in consumption, the removal of tariffs also leads to a contraction of imports of good 3 from country C, which is harmful trade diversion. Country B benefits from trade creation while country C loses from trade diversion.

The net effect on country A depends on the relative magnitude of these two effects. As the domestic good (good 1) and imported good 2 are net substitutes, with a fixed trade balance, the tariff removal expands the value of exports by country A at world prices. If the value of imports of good 2 expands more than the contraction in the value of imports of good 3, the beneficial effect of trade creation dominates the harmful effect of trade diversion. To what extent this will occur depends on the substitutability between each pair of goods as well as the relative magnitudes of the relevant tariffs. As Panagariya and Duttagupta (1999) have pointed out, this analytical ambiguity assigns a critical role to parameters in GE models determining the degree of substitutability between the domestic and imported composite, on the one hand, and between import sources, on the other.

This analytical model, though simple, is useful for illustrating the complexity of PTA analysis. It shows that the GE effects of non-reciprocal PTAs depend on whether goods are net complements to, or substitutes for, the goods whose imports are being liberalised. In reality, however, other important factors may interact with the factors specified in the simple model, such as trade in and use of intermediate inputs in production and saving-investment decisions. A GE model of world trade between many countries and regions accounts for many

of the features that are relevant to analysing the effects of PTAs.[3] Within such a comprehensive framework, the effects highlighted in the analytical model presented above are still present; however, they will be intertwined with and influenced by other factors that are incorporated into a GE model. The net outcome will be more difficult to predict in an applied GE model than in an analytical GE model. The results are dependent on the parameter settings, data and the model's structure.

3 Numerical models and databases

We are interest in determining the size and the sign of the effects of a nonreciprocal PTA by Australia with LDCs. To capture the complexity of such a policy change, we apply two numerical models: an applied GE model and a post-solution model. The former is used to capture the effects on Australia and its major trading partners. The latter is used to quantify the effects on exports by LDCs to Australia, and exports to Australia by other countries of interest that are not separately identified in the database of the applied GE model.

3.1 The applied GE model and database

The applied GE model used here is the GTAP model, version 6.1.[4] The model divides the world economy into geographical regions and each regional economy into industries. Goods produced by an industry in different regions are assumed to be imperfect substitutes for imports. Domestic and imported goods form constant elasticity of substitution (CES)

[3] For applied GE analyses of non-reciprocal PTAs, see Brown (1988, 1989); Srinivasan, Whalley and Wooton (1993); and Robinson and Thierfelder (1999).

[4] The original model is documented in Hertel (1997). Version 6.1 is available at http://www.agecon.purdue.edu/GTAP/. The experiment was implemented using the GEMPACK software suite (Harrison and Pearson 1996).

composites which are used by the household, the government and firms in consumption, production and investment formation.

Within each region, a single household represents both consumers and factor owners. Consumers are assumed to have identical preferences over composite goods. The government collects taxes and spends them on goods provided to households for final consumption. Total regional income is allocated between household consumption, government consumption and savings. Consumers' demands for goods and services have constant difference of elasticities (CDE) functional forms. Industries use composite intermediate inputs and primary factors of production to produce outputs. Production technologies exhibit constant returns to scale. Composite intermediate inputs are used in fixed proportions while primary factors of production are substitutable with each other in total value-added. Among the five primary factors of production specified in the model, skilled, unskilled labour and capital are perfectly mobile across domestic industries, while land and natural resources are immobile and are used only in agricultural and mining industries. All primary factors are immobile internationally. Returns to factors of production accrue to households in the form of income which, in turn, finances consumption demand and savings. Household savings can finance either domestic or foreign investment.

At the macroeconomic level, household consumption, government consumption and net (of depreciation) savings in each region are a variable share of regional income. These aggregates vary in response to changes in regional income and prices.[5] It is assumed that net investment will be reallocated across regions to equalise the expected rate of return on regional investment. All changes are evaluated relative to a price index for the world endowment of factors, which serves as the numeraire. The model is comparative static: it

[5] This behaviour is the result of combining a Cobb-Douglas utility function with a CDE functional form for consumer demand (see McDougall 2002).

compares two static equilibrium situations for regional and global economies under alternative policy scenarios with no reference to the time path between the two equilibrium points.

The database used in our simulations is the GTAP database version 5 (Dimaranan and McDougall 2002), where 1997 is the base year. The original database divides the world into 66 regional economies, each of which consists of 57 industries. Bilateral trade data are combined with protection and transportation cost data to represent fundamental international trade linkages across regions. Detailed input–output databases account for the inter-sectoral linkages and other economic relationships within each regional economy. For the purposes of this study, the database is aggregated into 39 regional groups and 43 industries (see tables 2 and 5). Within the 39 aggregated regions, 13 regions include LDCs. Of these 13 regions, six are individual LDCs (Bangladesh, Malawi, Mozambique, United Republic of Tanzania, Uganda and Zambia) and seven are regional groups including some LDCs (Rest of South Asia, Central America and the Caribbean, Rest of Middle East, Rest of South African Customs Union, Rest of Southern Africa, Rest of Sub-Saharan Africa and the Rest of World).

3.2 The post-solution model and database

A post-solution simulation model is developed to quantify the impacts of preferential liberalisation on Australian trading partners of interest, which are not identified separately in the model database. The post-solution simulation is based on a model describing Australian demand for imports originating from each of the countries included in the 7 aggregate LDC-inclusive regions in the database (i.e., Rest of South Asia, Central America and the Caribbean, Rest of Middle East, Rest of South African Customs Union, Rest of Southern Africa, Rest of Sub-Saharan Africa and the Rest of World). The import demand functions are of CES form.

Thus, the post-solution simulation model assumes that, for Australian users, imports of commodities from different countries are (imperfectly) substitutable with each other.

In percentage change form, the demand for a given imported commodity from country *i*, q_i, (where country *i* is part of an aggregated region) is expressed as,

$$q_i = q - \sigma (p_i - p), \qquad \sigma \geq 0, \tag{1}$$

where q denotes the percentage change in the demand for composite imports of the given commodity from all countries in the aggregated region; p_i is the domestic price (in Australia) of the imported commodity from country *i*; p is the average price of the imported commodity from all countries in the aggregated region, weighted by the shares in the value of total imports of the given commodity; and σ is the CES between any pair of imports of the given commodity from two source countries.

The domestic price (in Australia) of the imported commodity from country *i*, p_i, is defined as,

$$p_i = p_{iw} + t_i \,, \tag{2}$$

where p_{iw} is the world (c.i.f.) price of the imported commodity from country *i*, and t_i is the power of *ad valorem* tariff rate for the imported commodity from country *i*.

The post-solution model is calibrated as follows. The value of σ is taken from the GTAP 5 database. The percentage changes in the world prices of imports, p_{iw}, and the Australian demand for total imports of a given commodity, q, are taken from the GE model simulation results. It is assumed that all countries in a given regional group face the same world prices for their exports (the small country assumption). Considering the small size of most economies included in those regional groups, this assumption seems reasonable. For instance, the simulated response in Australian demand for imports of clothing from Cambodia is a function of the projected change in the price and quantity of imports of clothing for the regional group in which Cambodia is included. The Australian domestic market price of a

given import commodity is, therefore, equal to the world price for the aggregated region plus the Australian tariff for the source region of the imported commodity.

The data on Australian imports used in the post-solution simulation model are obtained from the Australian Bureau of Statistics (ABS) and other sources.[6] They include the values of imports from all sources at the HS 4-digit level and the values of duties paid on relevant imports. The HS trade data are aggregated to match the 42 traded commodity groups (not including services) in the model database. The *ad valorem* tariff rates are calculated as the value of duties paid divided by the c.i.f. value of imports. The 42 LDCs that exported to Australia in 1997, and which are included in the post-simulation analysis, are listed in the appendix.

4 Australia's trade with LDCs and tariff structure

Let us now briefly describe Australia's trade with LDCs and existing tariffs on imports from LDCs, as these will be important in determining the effects of Australia providing duty-free access to LDCs. Australia currently provides preferential market access for developing countries under the Australian System of Tariff Preferences (ASTP) scheme and SPARTECA. The ASTP scheme reduces the tariff rate for imports from developing countries by 5 percentage points if MFN rates not zero or above 5 per cent, while SPARTECA allows duty-free entry for imports from member countries.

The ASTP scheme excludes some products from tariff preferences, including important LDC exports, such as textiles, clothing and footwear (TCF). Non-SPARTECA LDCs still face high tariffs in some categories of TCF, particularly apparel and certain finished textiles.

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[6] Data were extracted from a variety of sources, including ABS (2002) *International Trade, Australia*, Cat. No. 5465.0, the World Bank's *World Development Indicators 2001 Database* and various UNCTAD, UN, WTO, World Bank and IMF publications. Australian production data was sourced from ABS (1998) *Manufacturing Production, Commodities Produced, Australia*, Cat. No. 8365.0.

TCF is an important export to Australia for these LDCs; imports from LDCs were valued at A$242 million in 2001-02, more than half of which were TCF. Australian imports from LDCs are primarily from Asian LDCs. Of these, Bangladesh accounts for around three-quarters of Australia's imports of TCF from LDCs.

The GTAP 5 database contains 1997 import tariff rates on Australian commodity imports originating from LDCs. However, these rates do not reflect the ASTP. Therefore, the tariff rates were modified to be consistent with the tariffs reported by the ABS trade statistics (2002). Table 1 reports the tariff rates for TCF imports only, as most tariffs on LDC imports by Australia are below 5 per cent.

Table 1 Average tariff rates on Australian TCF imports from LDCs, 1997 (per cent)

Country	*Textiles*	*Clothing*	*Footwear*
Bangladesh	0.10	33.36	1.40
Tanzania	0	31.91	0
Uganda	0	34.16	0
Haiti	0	29.17	0
Cambodia	12.70	29.69	0
Laos PD Republic	0	29.20	0
Burma	9.88	18.40	0
Maldives	0	25.29	0
Nepal	0.96	8.87	0.46
Lesotho	0	33.74	0
Democratic Republic of Congo	0	34.19	0
Ethiopia	0	27.08	0
Gambia	13.64	0	0
Madagascar	0	8.71	0
Mali	0	18.97	0
Senegal	14.22	14.07	8.76

Note: (1) The average tariff rates are calculated using import values as weights. (2) LDCs with no TCF exports to Australia or not subject to Australia TCF tariffs are not included in the table.

Source: ABS (2002).

Our policy experiment consists of removing all remaining tariffs on Australian imports from LDCs in the adjusted database. For the 6 regions representing individual LDCs, the removal of all tariffs on imports into Australia is relatively straightforward: all tariffs are reduced to zero. For the 7 regional groupings that include only some LDCs, the regional tariffs are removed in proportion to the LDC duty shares. The duty shares are calculated from

Australia's trade statistics (ABS 2002). In the post-solution model, Australian tariffs are removed for the imports of all LDCs that are not specified individually in the GE simulation.

5 Simulation results and discussion

Table 2 presents the general effects of the Australian initiative on all LDCs and other regions in the world, in terms of percentage changes in real gross domestic product (GDP) and trade. Almost all LDCs and LDC-inclusive regions are projected to benefit from the preferential access to Australian markets in terms of real GDP, with Bangladesh and other South Asian countries being the major beneficiaries. Some LDCs are projected to be slightly worse off; these are among those with little or no trade with Australia, or trade in commodities which attract low or no tariffs.

Australia is projected to be worse off, as predicted by the analytical model presented in section 2. However, the loss is negligible due to the small size of the overall tariffs removed and the small share of imports from LDCs into Australia. Nonetheless, as Australian domestic goods are assumed to be substitutable for imports from LDCs, the Australian terms of trade are affected adversely. This effect contributes largely to the overall loss for Australia. The reverse is true for the beneficiary LDCs. Most other trading partner countries are largely unaffected by the Australian LDC initiative. They experience either small gains or small losses, depending, among other things, to what extent their exports compete with LDC exports in the Australian market.

Table 2 Simulated effects on LDCs' and other countries' real GDP and trade (per cent)

Region	*Real GDP*	*Export volume*	*Import volume*
LDC regions			
Bangladesh [a]	0.000662	0.017961	0.041132
Rest of South Asia [b]	0.000127	-0.001205	0.002746
Rest of World [b]	0.000080	0.001684	0.003022
Uganda [a]	0.000061	-0.001584	0.003443
Central America and the Caribbean [b]	0.000022	-0.000049	0.000220
Rest of Sub-Saharan Africa [b]	0.000013	0.000072	0.000261
Mozambique [a]	0.000012	-0.000408	0.000118
Rest of Southern Africa [b]	0.000127	-0.001025	0.002746
Tanzania [a]	0.000009	-0.000023	0.000249
Malawi [a]	0.000005	-0.000078	0.000135
Rest of Middle East [b]	0.000002	-0.000001	-0.000007
Rest of South African Customs Union [b]	-0.000002	0.000048	-0.000034
Zambia [a]	-0.000010	-0.000001	-0.000184
Non-LDC regions			
Australia	-0.000264	0.006333	0.004301
New Zealand	-0.000046	-0.000393	-0.000976
China	0.000005	-0.000077	-0.000352
Hong Kong	0.000011	0.000067	0.000143
Japan	..	0.000054	-0.000008
Korea	0.000001	0.000017	0.000072
Taiwan	0.000001	0.000003	0.000006
Indonesia	0.000002	-0.000012	-0.000056
Malaysia	0.000009	0.000006	0.000028
Philippines	0.000011	-0.000022	0.000033
Singapore	0.000004	-0.000016	0.000020
Thailand	0.000007	0.000018	0.000009
Vietnam	-0.000036	-0.000209	-0.000336
India	0.000006	0.000087	0.000063
Sri Lanka	0.000032	-0.000082	0.000050
Canada	-0.000002	-0.000004	-0.000031
United States	-0.000001	-0.000025	-0.000095
Rest of Latin America	..	0.000018	-0.000005
European Union	-0.000003	0.000008	-0.000026
Rest of Western Europe	..	0.000008	-0.000027
Eastern Europe	..	0.000030	0.000023
Turkey	0.000003	0.000047	0.000136
Morocco	0.000018	0.000118	0.000219
Rest of North Africa	0.000008	0.000040	0.000099
Botswana	-0.000005	0.000050	0.000014
Zimbabwe	-0.000010	-0.000001	-0.000184
Total	**-0.000002**	**0.000098**	**0.000098**

[a] Individual LDC. [b] Region inclusive of LDCs. .. Less than 0.000001 per cent.

Source: GTAP simulation.

Previous discussion has shown that according to current trade patterns, the changes in tariff preference are likely to affect mainly trade in clothing, sourced from a few LDCs, such

as Bangladesh, Burma, Cambodia and Nepal. The parts of the clothing sector in Australia and other countries that compete directly with LDCs in the Australian market, such as Fiji and China, are also adversely affected.

Table 3 reports the simulated effects of the policy change on LDC exports to Australia. It shows that clothing exports to Australia from LDCs are projected to increase. In particular, clothing exports from Bangladesh to Australia are predicted to increase 11-fold. Exports to Australia from Cambodia, Burma and Nepal are also projected to increase by large proportions. Clothing exports account for almost the entire rise in LDC exports to Australia. Overall, total export volumes from LDCs to Australia are projected to increase by 12 per cent, which is driven mainly by a 5-fold increase in exports of clothing.

As Bangladesh is a separate region in the database, the effects on this LDC economy can be discussed in more detail. Table 4 reports the projected changes in some indicators of the Bangladeshi economy. The table shows that a country benefiting from the tariff preference increases its exports to Australia by diverting some of their traditional TCF exports from other destinations (in the case of Bangladesh, away from the United States and the European Union). Meanwhile, as its export market expands, it diverts resources away from other parts of the economy into its clothing sector. As a result, Bangladesh's clothing industry is projected to expand by more than any other sector (0.15 per cent).

Table 3 Simulated effects on LDCs' exports to Australia

LDC	*Total export volume*		*Clothing export volume*	
	%	A$1,000[a]	%	A$1,000[a]
Asia				
Afghanistan	-0.06	..	..	..
Bangladesh [b]	32.69	14,520	1,150.19	14,431
Bhutan	-0.02	..	..	..
Burma	14.62	1331	160.59	1,327
Cambodia	129.99	2,617	259.94	2,606
Laos People's Democratic Republic	126.46	141	255.67	141
Nepal	52.63	1,115	77.34	1,104
Africa				
Comoros, Republic	-0.02	..	..	..
Democratic Republic of Congo	0.53	2	313.15	2
Equatorial Guinea	-0.01	..	..	..
Eritrea	1.28	..	..	..
Ethiopia	1.73	31	250.54	2
Gambia	3.00	..	12.26	..
Guinea	-0.01	..	..	..
Lesotho	0.17	..	296.30	..
Liberia	0.46	..	..	..
Madagascar	8.56	75	88.91	75
Malawi [b]	-0.01	..	-0.58	..
Mali	7.86	27	179.16	1
Mauritania	-0.01	..	..	..
Mozambique [b]	1.25	1	-0.58	..
Senegal	7.54	3	136.11	..
Sierra Leone	-0.04	..	..	..
Tanzania [b]	..	..	0.72	..
Uganda [b]	0.29	18	1,219.06	19
Zambia [b]	..	..	-0.58	..
Others				
Haiti	5.32	2	256.05	1
Kiribati (SPARTECA)	3.83	21	..	..
Maldives	13.25	..	221.76	..
Samoa (SPARTECA)	-0.02	-12	..	..
Solomon Islands (SPARTECA)	0.02	1	..	..
Vanuatu (SPARTECA)	0.41	5	-1.29	..
Sum of LDCs	**12.48**	**19,899**	**423.10**	**19,710**

Notes: (1) [a] Based on 1997 Australian import values. (2) [b] Identified separately in GTAP. (3) The following 8 LDCs with no exports to Australia in 1997 are excluded from the table: Tuvalu (SPARTECA), Cape Verde, Central Africa Republic, Chad, Benin, Djibouti, Guinea Bissau and Burkina Faso. (4) The following 9 LDCs with simulated change less than 0.005 per cent or A$500 are excluded from the table: Yemen, Angola, Burundi, Niger, Rwanda, Sao Tome PR, Somalia, Sudan and Togo. (5) .. less than 0.005 per cent or A$500.

Source: GTAP and post-solution simulations.

Table 4 Simulated effects on Bangladesh

Indicator	*%*
Clothing sector	
Exports to Australia	1,151
Exports to EU and USA	-0.58
Domestic clothing output	0.15
Macro	
Real GDP	0.001
Real consumption	0.005
Real aggregate exports	0.018
Real aggregate imports	0.041

Source: GTAP simulation.

Inputs into the clothing industry increase to accommodate the increase in exports and production. This includes increases in domestically-produced inputs (such as cotton) and imported inputs. Other imports also increase in response to increased real consumption. Both effects are reflected in the increase in aggregate imports (table 4). Overall, there is a positive gain in real GDP and real consumption in Bangladesh. The same results are observed for those LDCs that have a well developed domestic clothing industry and established clothing exports to the Australian market.

The effect of tariff preference on the trading partner countries that have been discriminated against depends on how substitutable their exports are for those from the beneficiary LDCs in the donor's market, and the size of their market share relative to that of LDCs. Given the parameters adopted in the database, the substitution between import sources are equal for all suppliers. As a result, it is market shares that determine the responsiveness of non-beneficiary trading partners.

For a large clothing exporter such as China (which supplies more than 30 per cent of Australian clothing imports), the effects of granting preferential access to LDC exports is very modest: a fall by about 0.57 per cent. As clothing is not dominant in Chinese exports, this fall has little overall impact on the Chinese economy, as seen in the change in real GDP in table 2. Moreover, the pattern of Chinese exports of clothing and intermediate inputs into clothing production (textiles and semi-finished clothing products) also contribute to the overall results

for China. China is a supplier of intermediate inputs to the clothing production of LDCs and other countries. Although China's direct exports of clothing to Australia are projected to fall, the rise of LDC clothing exports encourages China's exports of textiles and semi-finished clothing to LDCs, which partly compensates for the fall in clothing exports to Australia.

For small developing countries relying heavily on clothing exports to Australia, especially members of SPARTECA, the potential impact of providing tariff preferences to LDCs is comparatively greater. For instance, Australia accounts for more than one-third of Fiji's exports. Exports of clothing account for around 25 per cent of all Fijian exports (UN 2000). Fiji's exports of clothing to Australia are projected to fall by about 1.3 per cent, or A$1.8 million. Although this is still small in percentage terms, this is likely to have an adverse effect on its domestic economy; much larger than the effects projected for other clothing exporters, such as China.

The simulated effects on Australian industries are reported in table 5. As expected, the Australian clothing industry is affected the most among all industries. However the effect is still modest; the output of clothing is projected to fall by just 0.12 per cent and the imports of clothing to rise by about 0.44 per cent. This is because imports from LDCs are a small share of total Australian imports. Australian demand for most imports falls except for parts of clothing (Wearing apparel), but overall import volumes still rise slightly by 0.043 per cent. Foreign demand for most Australian exports increases, which drives up the output of most industries.

Table 5 Simulated effects on Australian industries (per cent)

Industry	*Domestic output*	*Export volume*	*Import volume*
Wearing apparel	-0.1165	0.0167	0.4355
Textiles	-0.0231	0.0075	-0.0322
Wool, silk-worm cocoons [a]	-0.0038	0.0026	-0.0244
Petroleum, coal products	-0.0001	0.0010	..
Services	..	0.0075	-0.0039
Paper products, publishing	0.0002	0.0053	-0.0030
Fishing [a]	0.0004	0.0023	-0.0013
Coal	0.0004	0.0005	..
Meat products n.e.c. [a]	0.0005	0.0053	-0.0030
Oil	0.0005	0.0010	-0.0004
Forestry [a]	0.0008	0.0071	-0.0032
Gas	0.0009	0.0001	..
Beverages and tobacco products [a]	0.0010	0.0099	-0.0057
Wood products	0.0011	0.0072	-0.0035
Cereal grains n.e.c. [a]	0.0012	0.0020	-0.0025
Crops n.e.c. [a]	0.0015	0.0049	-0.0012
Food products n.e.c.	0.0015	0.0071	-0.0032
Animal products n.e.c.	0.0016	0.0061	-0.0027
Mineral products n.e.c.	0.0017	0.0089	-0.0031
Vegetables, fruit, nuts [a]	0.0018	0.0058	-0.0015
Raw milk [a]	0.0018	0.0057	-0.0027
Dairy products	0.0018	0.0054	-0.0020
Bovine cattle, sheep and goats, horses [a]	0.0020	0.0028	-0.0008
Metal products	0.0020	0.0100	-0.0034
Vegetable oils and fats [a]	0.0021	0.0057	-0.0011
Chemical, rubber, plastic products	0.0022	0.0055	-0.0013
Bovine cattle, sheep and goat meat	0.0024	0.0047	-0.0020
Sugar cane, sugar beet [a]	0.0024	0.0040	-0.0007
Sugar	0.0025	0.0044	0.0019
Wheat [a]	0.0025	0.0028	-0.0005
Oil seeds	0.0025	0.0048	0.0005
Paddy rice [a]	0.0027	0.0032	-0.0010
Plant-based fibers [a]	0.0027	0.0052	-0.0280
Processed rice	0.0027	0.0054	-0.0027
Minerals n.e.c.	0.0039	0.0037	0.0022
Machinery and equipment n.e.c.	0.0044	0.0091	-0.0018
Ferrous metals	0.0047	0.0088	-0.0012
Motor vehicles and parts	0.0047	0.0161	-0.0050
Electronic equipment	0.0048	0.0080	-0.0009
Manufactures n.e.c.	0.0048	0.0093	-0.0025
Transport equipment n.e.c.	0.0058	0.0148	-0.0052
Leather products	0.0063	0.0173	0.0001
Metals n.e.c.	0.0070	0.0078	-0.0004

Note: (1) [a] Agricultural products. (2) n.e.c.: not elsewhere classified. (3) .. less than 0.00005 per cent.

Source: GTAP simulation.

As discussed in section 2, the effects of PTAs depend, among other things, on the substitutability between domestic goods and the goods imported from various trading

partners. In the case of the Australian LDC initiative, the simulation results are particularly sensitive to the substitution elasticities between Australian domestic clothing products and the imports of clothing products from LDCs and other trading partners. The results presented above are based on the parameters in the database applied here, in which the elasticity of substitution between Australian domestic clothing and the composite of imported clothing is 4.4 while that between any pair of import sources is 8.8, both of which are quite high, compared with that for other products. If clothing products from different countries are assumed to be less substitutable than that implied by the parameters used here, the effects of the Australian LDC initiative are likely to be smaller.[7]

6 Summary and concluding remarks

Australia, along with other industrialised countries, has committed itself to provide tariff- and quota-free access to its markets for least-developed countries (LDCs), in line with the Doha ministerial declaration (UNCTAD 2001a). Here we use an applied general equilibrium (GE) model of world trade and a post-solution model, to quantify the economic effects of Australia adopting such a policy. Our results suggest that the general effects are quite small for Australia but significant for LDCs. The major effects are largely consistent with predictions from a simple three-region three-good analytical model.

First, preference receivers, especially those exporting to Australia, are projected to benefit, as the analytical model predicts. Accordingly, the gains tend to be concentrated in major LDC clothing exporters due to high tariffs that clothing products attract. Second, the extent to which other trading partners might benefit depends on several factors, which are identified in the analytical model; the substitutability between exports from different trading

[7] This view is supported by a similarity analysis conducted by PC (2002), which indicates possible low substitutability between Australian domestic clothing products and clothing imports, and between clothing products imported from different countries.

partners and the levels of tariffs their products attract. In this case, the overall effect depends also on the importance of clothing exports in their domestic economies. Third, for the preference-giving country, Australia, the general effect is negative, as expected. This reflects the dominance of trade diversion over trade creation effects and adverse terms of trade effects. However, the magnitude of the adverse effects on Australian industries in general, and the clothing industry in particular, are small due to the limited size of LDC imports. These projections are closely in line with those obtained in similar studies such as UNCTAD's analysis on Quad LDC initiatives (2001a). If one was to view this initiative as an exercise in foreign aid, it suggests that Australia can provide a significant benefit to the poorest nations with which it trades, at almost no cost to itself.

Moreover, the GE results also reveal some interactions and effects that the simple analytical model is unable to capture. For instance, the numerical model shows that some countries competing with LDCs in Australian markets, such as China, may not necessarily lose from such a policy change, because they can benefit indirectly from increasing their exports of intermediate inputs to the exporting sectors in LDCs. These interactions can only be accurately captured by an applied GE model, thus aiding in understanding the complexity of analysing preferential trading arrangements.

It should also be noted that applied GE models also have their limitations. For instance, these models still do not capture all the factors that may determine the outcome of preferential liberalisation. In the real world, to what extent a beneficiary trading partner can gain from such a policy change depends significantly on the responsiveness of its domestic industries. The responsiveness of domestic production is likely to vary significantly across LDCs, and these differences are not explicitly captured in the GE model applied here. In LDCs with limited responsiveness, a favourable external opportunity may not be sufficiently strong enough to overcome all the domestic constraints, such as underdeveloped infrastructure and

shortage of some factors of production. Efforts in capacity building in LDCs, for example, may improve their infrastructure. Some LDCs would then become more attractive places for foreign investment or technology transfer, and offer opportunities for industrialised countries to reallocate more labour intensive sections of production to these countries. A model explicitly incorporating foreign investment would capture the effects of such globalisation of production. Moreover, a dynamic framework would be needed to illustrate the process of reallocating production facilities and movement of productive factors across countries. Despite this, the analysis presented here represents an important first pass at measuring some of the major effects of Australia granting duty-free access to its markets for LDCs; effects which are of interest to policy makers and scholars in Australia, LDCs and other countries.

Appendix

LDCs in the post-solution model

GTAP model region	*Post-solution simulation model region*
Bangladesh	Bangladesh
Malawi	Malawi
Mozambique	Mozambique
Tanzania	Tanzania
Zambia	Zambia
Uganda	Uganda
Central America and the Caribbean	Haiti
Rest of Middle East	Yemen
Rest of World	Afghanistan
Rest of World	Cambodia
Rest of World	Laos People's Democratic Republic
Rest of World	Burma
Rest of World	Kiribati (SPARTECA)
Rest of World	Samoa (SPARTECA)
Rest of World	Solomon Islands (SPARTECA)
Rest of World	Tuvalu (SPARTECA)
Rest of World	Vanuatu (SPARTECA)
Rest of South Asia	Bhutan
Rest of South Asia	Maldives
Rest of South Asia	Nepal
Rest of South African Customs Union	Lesotho
Rest of Southern Africa	Angola
Rest of Sub-Saharan Africa	Burundi
Rest of Sub-Saharan Africa	Cape Verde
Rest of Sub-Saharan Africa	Central Africa Republic
Rest of Sub-Saharan Africa	Chad
Rest of Sub-Saharan Africa	Comoros, Republic
Rest of Sub-Saharan Africa	Benin
Rest of Sub-Saharan Africa	Equatorial Guinea
Rest of Sub-Saharan Africa	Democratic Republic of Congo
Rest of Sub-Saharan Africa	Ethiopia
Rest of Sub-Saharan Africa	Djibouti
Rest of Sub-Saharan Africa	Gambia
Rest of Sub-Saharan Africa	Guinea
Rest of Sub-Saharan Africa	Liberia
Rest of Sub-Saharan Africa	Madagascar
Rest of Sub-Saharan Africa	Mali
Rest of Sub-Saharan Africa	Mauritania
Rest of Sub-Saharan Africa	Niger
Rest of Sub-Saharan Africa	Guinea Bissau
Rest of Sub-Saharan Africa	Rwanda
Rest of Sub-Saharan Africa	Sao Tome PR
Rest of Sub-Saharan Africa	Senegal
Rest of Sub-Saharan Africa	Sierra Leone
Rest of Sub-Saharan Africa	Somalia
Rest of Sub-Saharan Africa	Sudan
Rest of Sub-Saharan Africa	Togo
Rest of Sub-Saharan Africa	Burkina Faso
Rest of Sub-Saharan Africa	Eritrea

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